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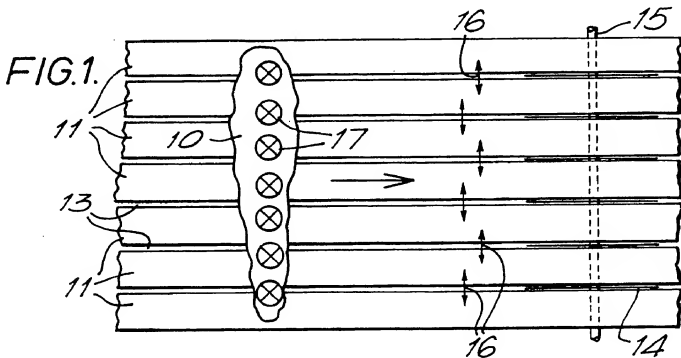
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(94) **Foodstuff cutting apparatus.**

(57) An apparatus for the automatic measuring and cutting of foodstuffs (10) to produce portions of a predetermined size or weight comprising a conveyor (11) for transporting the foodstuffs (10) in a downstream direction, an ultrasonic measuring device (17) adapted to take information on the shape and size of the foodstuffs (10) as they are transported on the conveyor (11), a cutting device (14) positioned

downstream of the ultrasonic measuring device (17), and a control unit adapted to receive and process the information from the ultrasonic measuring device (17) and then actuate the cutting of the foodstuffs (10) by the cutting device (14) into portions substantially equal to the predetermined size.



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FOODSTUFF CUTTING APPARATUS

The present invention relates to an apparatus for cutting foodstuffs, more particularly to a device for automatically measuring and cutting foodstuffs.

The cutting of fish portions is often carried out these days by apparatus which comprise weighing machines. However, the weighing machines employed are usually mechanically complex and space consuming. We have now devised a method of measuring and cutting foodstuffs which is both mechanically simple and space saving.

Accordingly, the present invention provides an apparatus for the automatic measuring and cutting of foodstuffs to produce portions of a predetermined size or weight comprising a conveyor for transporting the foodstuffs in a downstream direction, an ultrasonic measuring device adapted to take information on the shape and size of the foodstuffs as they are transported on the conveyor, a cutting device positioned downstream of the ultrasonic measuring device, and a control unit adapted to receive and process the information from the ultrasonic measuring device and then actuate the cutting of the foodstuffs by the cutting device into portions substantially equal to the predetermined size.

The present invention is especially suitable for cutting fish or meat, especially frozen fish fillets.

The ultrasonic measuring device may comprise a plurality of sensors mounted above or below the conveyor the number of sensors being proportional to the length of the foodstuff. When the foodstuff passes beneath the sensors, each sensor measures a section of the foodstuff, the number of measurements taken being proportional to the size of the foodstuff and the requirements for weight accuracy. The measuring device records information on the section area, the belt speed the length and the thickness at several points over the surface and passes this information to the control unit. The section area is obtained by measuring the thickness of the foodstuff section in each section point and the volume of each piece to be cut is calculated from the product of the section area and the length.

The control unit is preferably a computer and is preprogrammed for the specific gravity and the desired weight of the foodstuff portion. After receiving the information from the ultrasonic measuring device, the control device calculates the length needed for a given piece weight and then actuates the cutting of the foodstuffs preferably by actuating the cutting device to move into the appropriate position to cut the foodstuff into the predetermined size.

The cutting device may comprise one or more

circular knives or circular saws or stamps with sharp edges.

The conveyor may be a single belt or it may comprise a plurality of parallel belts mounted on common shafts with a spacing of, for instance, 10 to 40 mm, more usually from 20 to 30 mm between adjacent belts.

The cutters of the cutting device may be parallel or transverse to the direction of motion of the conveyor. When the cutters are parallel to the conveyor belts, they lie with their cutting edges in the gaps between the belts and they may be adapted to move laterally into the appropriate cutting position by conventional methods. However, the lateral motion is conveniently, steplessly automatic and may advantageously be controlled by pulse motors and forks. When the cutters are transverse to the conveyor belt or belts they lie above the belt and descend to cut the foodstuff.

The present invention also provides a process for the automatic measuring and cutting of foodstuffs to produce portions of a predetermined size which comprises transporting a foodstuff along a conveyor in a downstream direction past an ultrasonic measuring device which takes information on the shape and size of the foodstuff, feeds the said information to a control unit which is adapted to receive and process the said information and then actuate the cutting by means of a cutting device positioned downstream of the ultrasonic measuring device to cut the foodstuffs into portions substantially equal to the predetermined size.

Conveniently, the belt speed may be from 6 to 20 metres per minute. The foodstuff may conveniently be transported past the measuring device transversely or longitudinally.

The present invention will now be further illustrated by way of example only with reference to the following drawings in which

Figure 1 is a diagrammatic top plan view of an apparatus in which a fish piece travels transversely along seven parallel conveyor belts with six cutting knives positioned in the gaps between and parallel to adjacent belts,

Figure 2 is a diagrammatic side sectional view of Figure 1,

Figures 3 and 4 are diagrammatic top plan views of apparatus in which fish fillets are measured while travelling transversely and then cut while travelling longitudinally

Figure 5 is a detailed side sectional view of a cutting device of the apparatus of Figure 1,

Figure 6 is a sectional view along the line A-A in Figure 5 looking in the direction of the arrows, and

Figures 7 and 8 are diagrammatic side sectional views showing the use of ultrasonic sensors for measuring thickness in two ways.

Referring to Figures 1,2,5 and 6 of the drawings, a loin 10 which is conical in shape i.e. broader and thicker at one end, obtained from a cod fillet after the tail has been cut off and the belly flap removed, is positioned transversely across seven parallel conveyor belts 11 trained about rollers 12 separated by gaps 13 between which are positioned six circular cutting knives 14 on a drive shaft 15 each knife being capable of sliding on the drive shaft 15 with stepless adjustable transverse movements within the gaps 13 as indicated by the arrows 16. Positioned above and below the belts 11 are ultrasonic sensors 17. The conveyor belts 11 are driven by the common drive shaft 18. Positioned beneath the upper runs of the conveyor belts 11 are endless support belts 19, arranged in pairs one on either side of a cutting knife 14, trained around a common drive shaft 20. The support belt units are supported by a non-rotating shaft 21. The support belts 19 are provided with side frames 22 each of which has a contact surface 23 on the side facing the knife 14. A support plate 24 is positioned beneath the upper runs of the conveyor belts 11 to cover the gaps between the belts to prevent the fish pieces falling through. The movement of the cutting knives is effected by pulse motors 25 with pistons 26 attached to arms 27 having forked ends 27a which slide in circumferential grooves 28 in rings 29 bolted to the cutting knives 14 around the drive shaft 15. The ultrasonic sensors 17 are linked to the pulse motors 25 by a computer (not shown).

In operation, the loin 10 travels along the conveyor belts 11 where the ultrasonic sensors 17 measure the belt speed, the length and the thickness at several points over the fish surface. This information is fed to the computer which calculates the section area and, by interpolating data from adjacent sensors, calculates the conicity of the loin. By multiplying the section area by the length, the computer calculates the volume of each piece to be cut. The computer is preprogrammed with data relating to the specific gravity and the desired weight for each portion to be cut and, by means of all this information, calculates the length needed for a given piece weight and actuates the pulse motors 25 which move the cutting knives 14 into the correct cutting position to cut the required size of chunk. When a pulse motor is actuated its piston 26 moves the arm 27 the lower forked end of which 27a is fitted into the groove 28 of the ring 29 which in turn causes the ring 29 and the cutting knife 14 to slide the appropriate distance in the appropriate direction on the drive shaft 15 so that the lower cutting edge which protrudes through the gap 13

between two conveyor belts 11 supported by the side frames 22 and contact surface 23 of the support belts 19 is in the correct cutting position to cut the loin into chunks of the desired weight. The chunks may afterwards be graded according to their weights or further processed.

Referring to Figures 3 and 4, frozen fish fillets 30 travel transversely on a conveyor belt 31 in the direction of the arrows beneath ultrasonic sensors 32. After measurement of the volume by the ultrasonic sensors the fish fillets are oriented so that they are positioned longitudinally to the direction of motion of the conveyor belt for cutting. In Figure 3, this is achieved by a turning pin 33 mounted above the belt in a fixed position. The fillets are turned by contact with the pin as they travel along the belt after which the fish fillets are transferred to an infeed belt 34 to the cutting unit 35 which is a vertically reciprocating circular saw or stamp with sharp edges. In Figure 4, the fish fillets are oriented by means of a pusher 36 which pushes them onto the infeed belt 37 to the cutting unit 38 which is a vertically reciprocating circular saw or stamp with sharp edges and, after cutting, to the outfeed belt 39. The information on the volume of the fish fillets is fed from the ultrasonic sensors to a computer which actuates a pulse motor (not shown) to stop and start the infeed belt 34,37 so that it travels intermittently the appropriate distance to ensure that the correct length of each fillet is cut equivalent to the desired weight. The fillets are then transported away on the outfeed belt 39 for further processing.

Figures 7 and 8 illustrate alternate methods of measuring thickness at a point over the fish surface by a sensor.

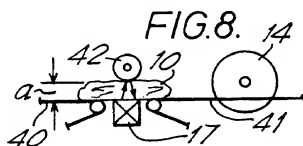
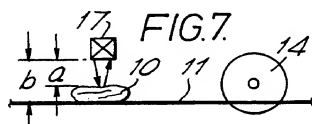
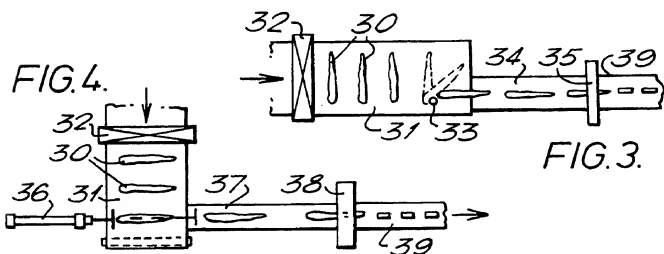
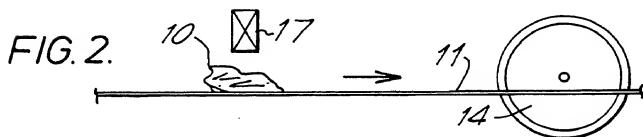
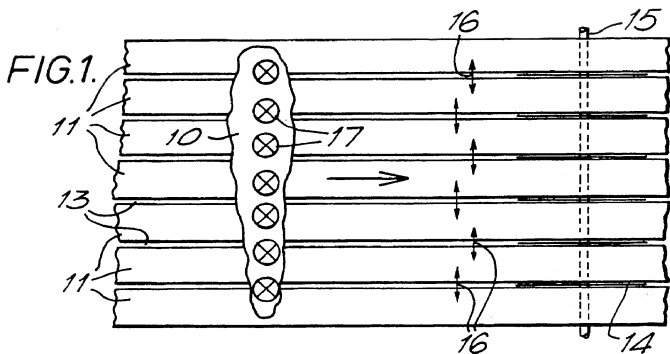
In Figure 7, the fish piece 10 travels along the conveyor belts 11 below the sensor 17 which measures the reflection through air from the surface to give the distance a. Since the distance b is known, the thickness is b-a.

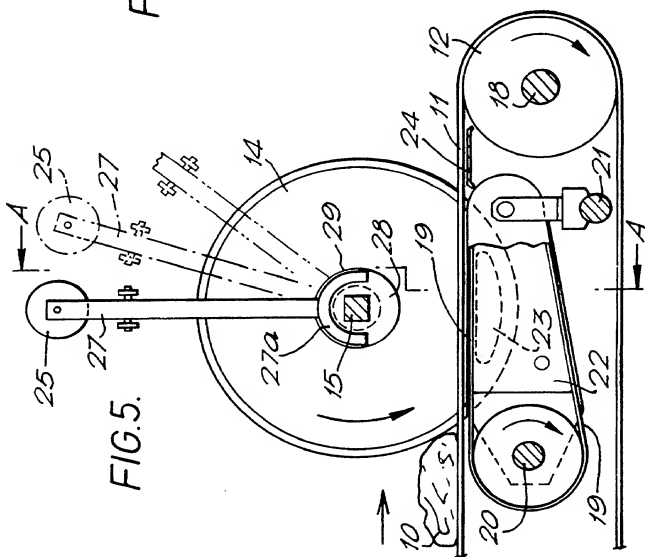
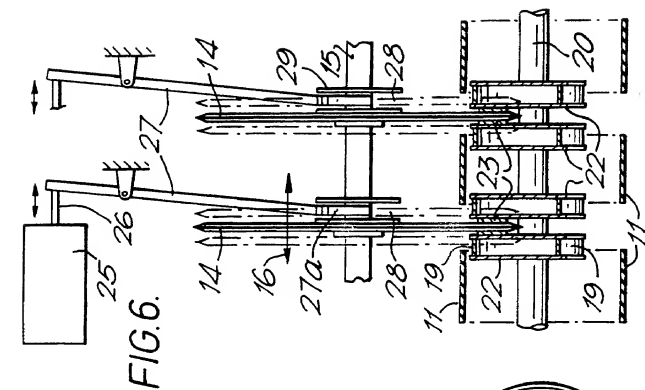
In Figure 8, the fish piece 10 first travels along conveyor belts 40 and then is transferred to conveyor belts 41. As the fish piece crosses the gap between the two sets of succeeding conveyor belts it passes beneath a pressure roller 42 and contacts sensor 17 which is positioned in the gap below the fish piece. The sensor 17, in this case, measures the reflection through the fish piece to give the thickness a.

The apparatus of the present invention is robust and unaffected by mechanical or other disturbances, or by a wet environment or to high pressure cleaning.

Claims

1. An apparatus for the automatic measuring and cutting of foodstuffs to produce portions of a pre-determined size or weight comprising a conveyor for transporting the foodstuffs in a downstream direction, an ultrasonic measuring device adapted to take information on the shape and size of the foodstuffs as they are transported on the conveyor, a cutting device positioned downstream of the ultrasonic measuring device, and a control unit adapted to receive and process the information from the ultrasonic measuring device and then actuate the cutting of the foodstuffs by the cutting device into portions substantially equal to the pre-determined size. 5
 2. An apparatus according to claim 1 wherein the ultrasonic measuring device comprises a plurality of sensors, the number of sensors being proportional to the length of the foodstuff. 10
 3. An apparatus according to claim 1 wherein the control device is a computer. 15
 4. An apparatus according to claim 1 wherein the conveyor comprises a plurality of parallel belts with a gap between adjacent belts. 20
 5. An apparatus according to claim 4 wherein the cutting device comprises a plurality of circular knives or saws parallel to the conveyor belts positioned with their cutting edges in the gaps between adjacent belts and adapted to move laterally to the cutting position by means of pulse motors. 25
 6. An apparatus according to claim 1 wherein the cutting device comprises one or more cutters transverse to the conveyor belt or belts and which lie above the belt and adapted to descend to cut the foodstuff. 30
 7. A process for the automatic measuring and cutting of foodstuffs to produce portions of a pre-determined size which comprises transporting a foodstuff along a conveyor in a downstream direction past an ultrasonic measuring device which takes information on the shape and size of the foodstuff, feeds the said information to a control unit which is adapted to receive and process the said information and then actuate the cutting by means of a cutting device positioned downstream of the ultrasonic measuring device to cut the foodstuffs into portions substantially equal to the pre-determined size. 35
 8. A process according to claim 7 characterised in that the foodstuff is transported past the measuring device transversely or longitudinally. 40
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EUROPEAN SEARCH REPORT

Application Number

EP 89 12 2139

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-4 557 019 (VAN DEVANTER) * Column 2, lines 25-51; figures 1-4 *	1-7	B 26 D 7/30
Y	EP-A-0 288 592 (FRISCO-FINDUS) * Page 4, lines 2-33; figures 1,2 *	1-7	
A	US-A-4 545 248 (KITADA) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B 26 D A 22 C G 01 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 31-07-1990	Examiner BERGHMANS H. F.
CATEGORY OF CITED DOCUMENTS			
<p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>& : member of the same patent family, corresponding document</p>			

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